NHDES-R-WD-02-11

STATE OF NEW HAMPSHIRE

2002 Section 305(b) and 303(d)

Consolidated Assessment and Listing Methodology

and

Comprehensive Monitoring Strategy

September, 2003

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CHAPTER 1 INTRODUCTION

1.1 PURPOSE

The Federal Water Pollution Control Act [PL92-500, commonly called the Clean Water Act (CWA)], as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (EPA) every two years. Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report"), that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water.

The second document is typically called the "303(d) List " which is so named because it is a requirement of Section 303(d) of the CWA. The 303(d) List includes surface waters that are:

1. impaired or threatened by a pollutant or pollutant(s)
2. not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources and
3. require development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

The primary purpose of this document is to describe the process used to make surface water quality attainment decisions for 305(b) reporting and 303(d) Listing purposes. This document is called the Consolidated Assessment and Listing Methodology (CALM) because it includes the methodology for assessing and listing waters (a term used to describe the process of putting a water on a 303(d) list). This year, several major improvements have been made to the assessment process, all of which are discussed in section 1.2.

A secondary purpose of this document is to report on the status of the comprehensive monitoring strategy for New Hampshire. This document, which is integrally related to the assessment and listing methodology, is discussed in Chapter 4.

Before proceeding it is important to understand that assessment methodologies are dynamic and likely to change as new information and assessment techniques become available. Such changes can also impact monitoring strategies designed to determine if waterbodies are attaining water quality standards. Periodic updates of the methodology will hopefully result in even more accurate and reliable assessments and, therefore, better management of water resources in the future.

1.2 IMPROVEMENTS TO THE ASSESSMENT PROCESS

1.2.1 New Assessment and Listing Methodology

This assessment and listing methodology is by far, the most comprehensive and detailed assessment strategy prepared to date for New Hampshire. Such detail promotes consistency in assessments and allows the public to clearly see how assessment decisions were made.

1.2.2 New Integrated Approach for 305(b) / 303(d)

In the past, New Hampshire, along with many other states, submitted separate 305(b) Reports and 303(d) Lists. To some, this was confusing as it was unclear how waters listed in the two documents were related. In an effort to eliminate this confusion and to simplify reporting for the public as well as regulatory agencies, EPA recently developed guidance and a computer database (the Assessment Database or ADB) to facilitate integration of the 305(b) and 303(d) List. For the 2002 reporting cycle, New Hampshire was one of the first states in the nation to use this new approach and database.

Based on a state's assessment and listing methodology, the guidance recommends that surface waters within state boundaries be placed into one (and only one) of the following seven categories:

1. Attaining the water quality standard and no use is threatened.
2. Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened (i.e., more data is needed to assess some of the uses).
3. Insufficient or no data and information are available to determine if any designated use is attained (i.e., more monitoring is needed to assess any use).
4. Impaired or threatened for one or more designated uses but does not require development of a TMDL because;
    a. a TMDL has been completed, or
    b. other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future, or
    c. the impairment is not caused by a pollutant.
5. Impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL (this is the 303(d) List).

Waters that are meeting water quality standards and are not threatened are included in Categories 1 and 2 with the difference being that all designated uses are supported in Category 1 whereas in Category 2, some, but not all uses are meeting standards. Category 2 and Category 3 waters require more monitoring before a complete assessment can be made. For Category 2 waters, monitoring is needed for those uses that lack sufficient data or information to make an assessment. For Category 3 waters, more monitoring is needed before an assessment can be made for any designated use.

Impaired waters or threatened waters are included in Categories 4a, 4b, 4c and 5. Category 4a includes waters impaired or threatened by a pollutant(s) and a TMDL study has been completed and approved by EPA. Category 4b includes waters impaired by a pollutant(s), but don't need a TMDL as other pollution control requirements such as technology standards for point sources (i.e., secondary treatment limits) or best management practices for nonpoint sources (i.e., capping of a landfill) are reasonably expected to meet water quality standards in the near future. Category 4c represents waters that are not impaired by a pollutant, such as a lack of sufficient flow to support aquatic life.

If a water is impaired or threatened and does not fall under any of the category 4 waters, it must, by default, fall under Category 5, which is the 303(d) List. These are waters that are impaired or threatened by a pollutant(s), a TMDL has not been done, and other pollution controls are not expected to result in attainment of water quality standards in the near future.

As discussed, under the integrated approach, all surface waters fall into one of the seven categories. Therefore, this reporting approach satisfies the 305(b) requirement to report on the water quality status of all surface waters. The Integrated Approach also clearly shows how the 303(d) List relates to other waters by assigning it a separate category (Category 5). As indicated, the 303(d) List does not include all impaired or threatened waters; rather it is a subset of the impaired or threatened waters.

1.2.3 New Assessment Database (ADB)

To facilitate electronic assessments, EPA developed the "Assessment Database", or ADB, in the 1990s. Though not required, states were strongly encouraged to use this reporting tool to file electronic reports to EPA. In 2002, EPA released a new Oracle-based version of the ADB that was based on the new integrated approach and its seven categories. For this reporting cycle, New Hampshire was one of the few states in the nation to use this new database for reporting.

1.2.4 New Assessment Units (AUs) and NHD coverage

Assessment Units (AU) are the basic unit of record for conducting and reporting water quality assessments. This year, a new system was developed and implemented to subdivide the surface waters of the state into approximately 5000 smaller segments or AUs. The system is based on 1:100,000 scale hydrography that is linked to the National Hydrography Dataset (NHD); the national coverage used by EPA. These improvements will greatly enhance the ability of DES to manage and report on the status of the State's water resources. Additional information regarding AUs and the NHD coverage is provided in section 3.1.

CHAPTER 2 WATER QUALITY STANDARDS

2.1 OVERVIEW

Before proceeding with details of the assessment methodology, it is important to obtain a basic understanding of water quality standards since they are the basis of all water quality assessments.

In general, water quality standards provide the baseline quality that all surface waters of the State must meet in order to protect their intended uses. They are the "yardstick" for identifying where water quality violations exist and for determining the effectiveness of regulatory pollution control and prevention programs.

Env-Ws 1700 includes the State's surface water quality regulations (NHDES, 1999). A downloadable copy of the regulations may be obtained from www.des.state.nh.us/wmb/wmbrules.htm.

The standards are composed of three parts: designated uses, water quality criteria, and antidegradation. Each of these components is briefly discussed below.

2.2 DESIGNATED USES

All surface waters of the State are either classified as Class A or B, with the majority of waters being Class B. DES maintains a list that includes a narrative description of all the legislative classified waters. Designated uses represent the desired uses that a waterbody should support. As indicated below, State statute RSA 485-A:8 is quite general with regards to designated uses for New Hampshire surface waters.

Classification	Designated Uses as described in RSA 485-A:8
Class A -	These are generally of the highest quality and are considered potentially usable for water supply after adequate treatment. Discharge of sewage or wastes is prohibited to waters of this classification.
Class B -	Of the second highest quality, these waters are considered acceptable for fishing, swimming and other recreational purposes, and, after adequate treatment, for use as water supplies.

As discussed in section 3.1.2, further review and interpretation of the surface water quality regulations (NHDES, 1999) reveals that that there are actually seven designated uses that the water quality standards are intended to protect.

2.3 WATER QUALITY CRITERIA

The second major component of the water quality standards is the "criteria". Criteria are designed to protect the designated uses of all surface waters and may be expressed in either numeric or narrative form. A waterbody that meets the criteria for its assigned classification is considered to meet its intended use. Water quality criteria for each classification may be found in RSA 485-A:8, I-V and in the State's surface water quality regulations (NHDES, 1999).

2.4 ANTIDEGRADATION

The third component of water quality standards is antidegradation which are provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the State's surface waters. Antidegradation regulations are included in Part Env-Ws 1708 of the State's surface water quality regulations (NHDES, 1999). According to Env-Ws 1708.03, antidegradation applies to the following:

- Any proposed new or increased activity, including point and nonpoint source discharges of pollutants that would lower water quality or affect the existing or designated uses;
- a proposed increase in loadings to a waterbody when the proposal is associated with existing activities;
- an increase in flow alteration over an existing alteration; and
- all hydrologic modifications, such as dam construction and water withdrawals.

CHAPTER 3 ASSESSMENT AND LISTING METHODOLOGY

3.1 GENERAL RULES

3.1.1 Waterbody Coverage, Waterbody Types and Assessment Units

Waterbody Coverage: This assessment is based on surface waters shown on the 1:100,000 National Hydrography Dataset (NHD), which is consistent with EPA's national coverage. Surface waters for which data was available to make an assessment, but which was not shown on the base NHD coverage, were added to this coverage on a case-by-case basis and linked to the NHD. NHD coverage at a finer scale of 1:24,000 is currently under development. Once complete, DES intends to use this coverage to improve the accuracy of its assessments.

Waterbody Types and Sizes: Based on the NHD coverage and to facilitate reporting, surface waters were separated into the five waterbody types shown below. The total size of each waterbody type, based on the coverage discussed in the previous section, is also provided.

Table 3-1: Waterbody Types and Sizes

Waterbody Type	Total Size	Total Number of Assessment Units
Freshwaters rivers and streams	9,625 Miles	3,147
Freshwater impoundments	21,746 Acres	805
Freshwater lakes and ponds	165,804 Acres	989
Estuaries	21.33 Square Miles	43
Ocean	70.33 Square Miles	22
	Total	5,006

Assessment Units (AUs): Each waterbody type was divided into smaller segments called assessment units (AUs). In general, AUs are the basic unit of record for conducting and reporting the results of all water quality assessments.

AUs are intended to be representative of homogenous segments; consequently, sampling stations within an AU can be assumed to be representative of the segment. In general, the size of AUs should not be so small that they result in an unmanageable number of AUs for reporting. On the other hand, AUs should not be so large that they result in grossly inaccurate assessments. Many factors can influence the homogeneity of a segment. Factors used to establish homogenous AUs for this assessment are presented in the following table. Based on the criteria shown in Table 3-2, surface waters in New Hampshire were divided into approximately 5000 AUs for assessment and reporting purposes.

Table 3-2: Factors used to establish Homogenous and Manageable AUs

Factor	Comments
Waterbody Type	Different waterbody types (i.e., river, lake, impoundment, estuary, ocean) have different water quality standards and may respond differently to pollutants. Consequently, to help ensure homogeneity, different AUs are needed for different waterbody types.
HUC-12 Boundaries	HUC stands for hydrologic unit code. Separate AUs were established wherever 12 digit HUC boundaries were crossed to prevent AUs from becoming too large and to facilitate the naming convention for AUs (discussed below).
Water Quality Standards	All waters represented by an AU should have the same water quality standard; otherwise it's possible that a portion of an AU could meet standards while the other portion is in violation. This would lead to inaccurate assessments.
Pollutant Sources:	The presence of major point and / or no point sources of pollutants can have a significant impact on water quality and, therefore, homogeneity within an AU.
Maximum AU size for rivers and streams	To keep AUs for rivers and streams from becoming too large, the following criteria were applied: AU $\leq$ 10 miles for rivers and streams of 3rd order or less AU $\leq$ 25 miles for rivers and streams greater than 3rd order
Major changes in Land Use	Land use can have a significant impact on pollutant loading and quality of surface waters.
Stream Order/Location of Major Tributaries	Stream order and location of major tributaries can have a significant impact on the quantity and quality of water due to the amount of dilution available to assimilate pollutants.
Public Water Supplies	Separate AUs were developed for these important surface waters to facilitate reporting.
Outstanding Resource Waters	Outstanding Resource Waters are defined in the surface water quality regulations (NHDES, 1999) as surface waters of exceptional recreational or ecological significance and include all surface waters of the national forests and surface waters designated as natural under RSA-483-7-a, I.
Shellfish Program Categories	Tidal waters were divided into AUs based on the classification system for the shellfish program to facilitate reporting.
Designated Beaches	Designated beaches have more stringent bacteria criteria; consequently separate AUs were established for these waterbodies.
Cold water fish spawning areas	Cold water fish spawning areas have different dissolved oxygen criteria than other surface waters; consequently separate AUs were established for these waterbodies where information was available from the New Hampshire Fish and Game Department.

AU Naming Convention: Each AU must have a unique identification number (i.e., AU ID) to facilitate tracking and reporting of assessment results for each AU. An explanation of the AU ID naming convention used in this assessment is provided in Table 3-3.

Table 3-3: Explanation of AU ID Naming Convention

Example AU ID: NHRIV801060405-01-01				
NH	RIV	801060405 -	01-	01
State abbreviation to readily identify the waterbody as being in New Hampshire (NH)	3 letters to readily identify the waterbody type where: RIV = Rivers and Streams LAK = Lakes and Ponds IMP = Impoundments EST = Estuary OCN= Ocean	Last 9 digits of the 12 digit HUC. Note that the first 3 digits of all NH HUCs are "010". The first 3 digits (010) were purposely left off in an effort keep the AU ID as short as possible. Inclusion of the last 9 digits readily identifies the general location of the waterbody. 12 digit HUCs do not exist for the ocean (they do, however exist for the estuaries). For the ocean, 000000000 was input into this field.	AU segment number. Segments were divided into homogenous units using the criteria above. For rivers, segment numbering starts upstream and proceeds downstream.	AU subsegment number. Used for further subdivision of AU if necessary. For example, this field was used if it was necessary to divide a lake into 2 or more segments.

3.1.2 Designated Uses

Designated uses are the desirable uses that surface waters should support such as swimming (i.e., primary contact recreation) and fishing (i.e., aquatic life). As discussed in section 2.2, State statute (RSA 485-A:8) is somewhat general with regards to designated uses for New Hampshire surface waters. Further review and interpretation of the regulations (Env-Ws 1700), however, reveals that the general uses can be expanded and refined to include the seven specific designated uses shown in Table 3-4. Each of these designated uses, with the exception of wildlife, were assessed for this reporting cycle. An assessment methodology for wildlife has not yet been developed but will be included in future assessments.

Table 3-4: Designated Uses for New Hampshire Surface Waters

Designated Use	DES Definition	Applicability
Aquatic Life	Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.	All surface waters
Fish Consumption	Waters that support fish free from contamination at levels that pose a human health risk to consumers.	All surface waters
Shellfish Consumption	Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers	All tidal surface waters
Drinking Water Supply	Waters that with conventional treatment will be suitable for human intake and meet state/federal drinking water regulations.	All fresh surface waters
Primary Contact Recreation (i.e. swimming)	Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water	All surface waters
Secondary Contact Recreation	Waters that support recreational uses that involve minor contact with the water.	All surface waters
Wildlife	Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.	All surface waters

3.1.3 Integrated Approach Categories

Each assessment unit (AU) was assigned to one (an only one) of the following seven assessment categories in the Assessment Database (ADB):

Category 1: Attaining the water quality standard and no use is threatened.

Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened (i.e., more data is needed to assess some of the uses).

Category 3: Insufficient or no data and information is available to determine if any designated use is attained (i.e., more monitoring is needed to assess any use).

Category 4a: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because a TMDL has been completed.

Category 4b: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.

Category 4c: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because the impairment is not caused by a pollutant, and

Category 5: Impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL (this is the 303(d) List).

3.1.4 Use Support Attainment Options and Threatened Flag

Each designated use for each assessment unit (AU) was assigned one of the following four use support attainment options in the ADB:

Fully Supporting: A use is fully supporting if, in accordance with this document, there is sufficient data or evidence for the core indicators (defined below) to determine that the use is fully supporting and, there is no other data or evidence indicating an impaired or threatened status.

Not Supporting: A use is not supporting (i.e., impaired) if, in accordance with this document, there is sufficient data or evidence to indicate impairment.

Insufficient Information: This option is assigned to any use associated with any Assessment Unit which, in accordance with this document, has some useable data or information but not enough to make a final assessment decision.

Not Assessed: This option is assigned to any use associated with any Assessment Unit, which does not have any useable data or information to make an assessment decision.

Threatened: For any of the use support options noted above, the ADB allows a water to be flagged as threatened. For this assessment a use was defined as threatened when there were no measured in-stream violations but other data [i.e. see sections 3.3.19 (predictive models) and 3.3.20 (NPDES permit effluent violations)] indicate the potential for water quality violations.

3.1.5 Causes (Pollutants and Nonpollutants) and Sources of Impairment

The Assessment Database (ADB) requires causes and sources of threatened or impaired waters to be input. These terms are defined below.

Causes: The "cause" of a threatened or impaired water is an assessment term used to describe the pollutant or nonpollutant, which is causing, or threatening to cause, a water quality violation. In general, a pollutant can be thought of as something, which can be expressed in terms of a loading (i.e. pounds per day) and physically allocated. For example, phosphorus and iron are considered pollutants. Only waters, which are threatened or impaired by pollutants, are eligible for TMDLs.

Conversely, a nonpollutant cannot be expressed in terms of a loading. TMDLs are not required for waters impaired by nonpollutants. Examples of nonpollutants include the following:

Exotic non-native invasive species
Flow alterations or other hydrologic modifications
Habitat degraded by physical conditions

In the ADB, each cause of impairment must be flagged as either a pollutant or nonpollutant. For reasons discussed in section 3.1.6, all causes of threatened or impaired waters that did not require a TMDL were flagged as nonpollutants in this assessment.

Sources: The "source" of a threatened or impaired water means the source of the pollutant or nonpollutant, which is threatening or causing water quality violations. For example, atmospheric deposition (acid rain) could be listed as the source of low pH, or wildlife as the source of bacteria violations.

In the ADB, any AU can have more than one cause or source of impairment.

3.1.6 Cases where Pollutants were Flagged as Nonpollutants in the ADB

The ADB automatically assigns each waterbody or assessment unit (AU) to one, and only one, category. Selection of the category is governed by the input. For example, if an AU is impaired by a pollutant and a TMDL is needed, the ADB automatically places the AU in Category 5 (i.e., 303(d) list- TMDL required), regardless of whether all of the pollutants in the AU need a TMDL or not.

This approach is fine when all the pollutants causing impairment in an AU require a TMDL. However, when there are multiple pollutants causing impairment in an AU and not all require a TMDL, it can lead to confusion regarding which pollutants were intended to have TMDLs conducted for them and which were not. This is the case for the 2002 cycle where all waters are listed under Category 5 for fish consumption advisories due to mercury.

To avoid confusion, only those pollutants in an AU requiring TMDLs were flagged as pollutants in the ADB. Any other pollutants threatening or causing impairment in the AU were flagged as nonpollutants since TMDLs are not required for nonpollutants. The decision making process for determining which pollutants required a TMDL is presented in section 3.1.23.

Causes of threatened or impaired waters which were flagged as nonpollutants in this assessment, included the following:

- Nonpollutants as defined in section 3.1.5
- Pollutants due to natural sources (see section 3.1.7)
- Pollutants for which a TMDL has already been completed (see section 3.1.23)
- Pollutants for which other controls are reasonably expected to result in attainment of water quality standards (see section 3.1.23)

3.1.7 "Naturally Occurring" Water Quality Exceedances

In New Hampshire, exceedances of most water quality criteria due to naturally occurring conditions are not considered violations of the water quality standards. According to Env-Ws 1702.29 of the State's surface water quality regulations (NHDES, 1999), naturally occurring conditions means "conditions which exist in the absence of human influences."

EPA guidance (USEPA, 1997) states that the natural sources category should only be used for waters impaired due to naturally occurring conditions (i.e., not caused by, or otherwise related to past or present human activity) or due to catastrophic conditions. Examples given by EPA for when use of natural sources might be appropriate include the following:

- Saline water due to natural mineral salt deposits
- Metals due to naturally occurring deposits
- Low dissolved oxygen (DO) or pH caused by poor aeration or natural organic materials, where no human-related sources are present or where impairment would occur even in the absence of human activity
- Excessive siltation due to glacial till or turbidity due to glacial flour, where such siltation is not caused by human activity or where impairment would occur even in the absence of human activity
- Habitat loss or pollutant loads due to catastrophic floods that are excluded from water quality standards or other regulations.
- High temperature, low DO, or high concentrations of pollutants due to catastrophic droughts with flows less than design flows in water quality standards.

The level of documentation needed to determine if the source is natural is dependent on the pollutant. Mathematical analyses or computer modeling, for example, may be needed for estimating natural levels of dissolved oxygen in some cases. On the other hand, a simple field reconnaissance may suffice to determine if a bacteria exceedance is likely due to man's activities or to wildlife. In either case, documentation is needed to support the "natural" determination.

For this assessment, low pH caused by naturally occurring organic acids, where the presence of organic acids is based on color measurements as described in section 3.2.4, was considered a natural source. Although there are other surface waters which are suspected of being impaired by other natural sources (such as bacteria exceedances due to wildlife), the source was listed as unknown for this cycle since a process has not yet been clearly defined for determining when the source can be considered natural. Once this is done, it is expected that number of waterbodies with exceedances attributed to natural sources will increase.

Currently, the ADB is not set up to specifically address situations where water quality standards allow for excursions of criteria due to natural sources. As previously mentioned, such exceedances are not, by definition, violations of the water quality standards. Consequently, it is not appropriate to include such waters on Category 5 (i.e., the 303(d) list). On the other hand, it is not accurate to report such waters as fully supporting as water quality criteria has been exceeded.

For this reporting cycle all causes of impairment (i.e. exceedances) due to natural sources, and where the basis of the natural determination is properly documented, were flagged as nonpollutants and linked to one of the natural source options offered in the ADB. By doing so it clearly distinguishes them from pollutants needing a TMDL, and tracks the water as impaired but due to a natural source.

3.1.8 Data Sources

In April 2002, a request for data/information for the 2002 305(b)/ 303(d) submission was sent to the following organizations. The request for information was also placed on the DES website for the general public (www.des.state.nh.us/wmb). Guidance and a form to facilitate electronic or mailed submissions were included on the website.

Appalachian Mountain Club
Audubon Society
Connecticut River Joint Commissions
Conservation Law Foundation
County Conservation Districts
Manchester Conservation Commission
Merrimack River Watershed Council
National Park Service
New Hampshire Rivers Council
North Country Council
Regional Planning Commissions
Society for the Protection of National Forests
The Nature Conservancy
Upper Merrimack River Local Advisory Committee
U.S. Environmental Protection Agency
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S. Forest Service
University of New Hampshire (UNH)

Information/ data received from the above was assessed in accordance with this methodology. Other data sources consulted for this assessment include the following:

1998 303(d) List (NHDES, 1998)
2000 305(b) Report (NHDES, 2000)

DES Ambient Rivers Monitoring Program (ARMP)
DES Volunteer Rivers Assessment Program (VRAP – includes data from approximately 10 volunteer monitoring groups)
DES Lake trophic surveys
DES Acid rain-lake monitoring program
DES Lake Diagnostic Feasiblity Studies

DES State Clean Lakes program (nuisance aquatic growths including exotic species)
DES Volunteer Lakes Assessment Program (VLAP – includes volunteer data from over 100 lakes)
DES Copper Sulfate Treatment Files
DES Watershed Assistance Section nonpoint source investigations
DES administered Section 319 Projects (nonpoint source)
DES Water Quality Complaint files
DES TMDL Program
DES Section 401 Water Quality Certification Program
DES Shellfish Program
DES Biomonitoring Program
DES Permits and Compliance Section (NPDES permits)
DES Water Supply Engineering Bureau (public water supplies)
DES Waste Division (hazardous waste sites)

Coastal 2000 Water Quality Monitoring (excluding sediments)
Great Bay Coast Watch Water Quality Monitoring
National Estuarine Research Reserve (NERR), UNH, and NH Estuary
NERR System-Wide Monitoring Program
NH Department of Health and Human Services (fish/shellfish consumption advisories)
Project (NHEP) Monthly Water Quality Monitoring
U.S. Geological Survey- New England Coastal States Basin Study

3.1.9 Data Quality

Data used to make final assessment decisions, must be defensible. Consequently it is extremely important that the quality of the data is known. This includes information about the procedures used for sample collection, sample analysis, data analysis and data reporting.

The ADB requires documentation of the data quality used to make a final assessment decision. In terms of the ADB, this is called the "level of information" for which there are four options to select from:

Level 1 = Low
Level 2 = Fair
Level 3 = Good
Level 4 = Excellent

Criteria for determining the appropriate level are provided in the table below. As shown, only data which is considered to be Level 2 or above can be used to make a final assessment. This is considered high quality data. As a reference, QA/QC procedures used by the DES are considered Level 3 or 4 and were used to help determine appropriate levels for data collected by others.

Data or information that is Level 1 is not considered defensible for use in final assessments. Such data, however, can and is used for making preliminary or screening level assessments, which help to guide future monitoring efforts.

Table 3-5: Level of Information Descriptions for Data Quality

Level of Information	Description	Assessment Applicability	Use Support Option(s) that can be used with this level of information
1 = Low	SOPs or QA/QC plan are not available or were not provided. SOPs or QA/QC plan is available but protocols were not followed, QA/QC results are inadequate, and /or there is inadequate metadata.	Screening Level assessments only	Not Assessed.
2 = Fair	SOPs or a QA/QC plan is available; SOPs were used for field and lab; QA/QC protocols were followed and QA/QC results and metadata are adequate; Samplers had some training;	Final Assessments	"Insufficient Information" "Fully Supporting" "Not Supporting"
3 = Good	An acceptable QA/QC plan is available; SOPs were used for field and lab; QA/QC protocols were followed and QA/QC results and metadata are adequate; Samplers were well trained.	Final Assessments	"Insufficient Information" "Fully Supporting" "Not Supporting"
4 = Excellent	An acceptable QA/QC plan is available; SOPs were used for field and lab; QA/QC protocols were followed and QA/QC results and metadata are adequate; Samplers were well trained and audited.	Final Assessments	"Insufficient Information" "Fully Supporting" "Not Supporting"

Use of Volunteer Data: In New Hampshire there are two very active volunteer monitoring programs coordinated by DES: the Volunteer Lake Assessment Program (VLAP) and the Volunteer River Assessment Program (VRAP). The quality of this data is considered to be in the range of Level 2 to 3 in most cases. For this reporting cycle, all such Volunteer data that was considered Level 2 or above (which is the majority) was used in the assessment.

3.1.10 Data Age

Use of out-dated information can result in assessments that are not representative of actual conditions in the waterbody. It is therefore important to establish data age requirements to increase the accuracy of assessments.

Obviously, the more current the data the more accurate the assessment. However, setting a maximum data age of one year, for example, would result in very few waters ever being assessed due to a lack of resources to collect the necessary data each year. Consequently, establishment of data age requirements must strike a balance between the desires to have the most current data possible, the amount of data needed to make an assessment, and the resources and time needed to collect the data. Bearing this in mind, maximum data age requirements for making use support decisions are shown in Table 3-6.

The data age requirements shown in Table 3-6 apply in all cases except waters previously listed as threatened or impaired (e.g., the 1998 303(d) list). In such cases, the data used to make the original assessment, regardless of its age, was included in the reassessment provided it met all other data requirements (including the minimum number of samples) stipulated elsewhere in this assessment methodology. This was done to prevent removal of waters from a threatened or impaired category based solely on data age. To do otherwise would promote inaction rather than action to address water quality concerns. Though a waterbody cannot be removed based solely on data age, it important to emphasize that it wasn't automatically listed as impaired in 2002. For example, if the reassessment revealed insufficient data to make an assessment (see section 3.1.16) even with the data used to originally list the water, the waterbody was assessed as having insufficient information. In such cases, the waterbody will be scheduled for future sampling to collect the required number of samples needed to make an assessment.

It should also be noted that although the maximum data age requirement for lakes and ponds is 10 years (versus five years for the other waterbody types), it has been found that the water quality of many lakes and ponds do not change dramatically with time due to their large volume and retention times (often on the order of years). Consequently use of 10 year old data for lakes and ponds, though not ideal, is believed to provide a reasonably accurate assessment of water quality conditions in most cases.

Table 3-6: Maximum Age of Data for Use in Assessments

Waterbody Type	Maximum Age of Data Eligible for Making Assessments (except for waters previously listed as threatened or impaired)
Rivers and Streams Impoundments Estuaries Ocean	5 years [1997 (inclusive) to present]
Lakes and Ponds	10 years [1992 (inclusive) to present]

3.1.11 Values Below Detection Limits

Results of many water quality samples are reported as below the analytical detection limit (nondetects). In such cases, the actual value is not known. When nondetect values were

reported and an actual value was needed for making an assessment, 50 percent of the analytical detection limit was used as the value.

3.1.12 Core Parameters

For any designated use, there are often many parameters that can be used to determine if the water is impaired (not supporting) or threatened. Criteria for making these decisions are described in this document. If any one of the parameters indicate a threatened or impaired status, as defined in this document, then the water will be reported as threatened or impaired in the ADB and placed in category 4A, 4B, 4C or 5.

However, to determine if a water is fully supporting for a particular use, it is necessary to identify the minimum number of parameters needed to make this decision. This is in recognition of the fact that it is not feasible to sample for every parameter that may affect a use.

The parameters comprising the minimum data set needed to assess a water as fully supporting are called core indicators. Core indicators are often different for each designated use. As a minimum, monitoring strategies designed to make use support assessments need to include the core indicators.

Table 3-7 shows what the final attainment status would be in the ADB based on the individual attainment status of the core indicators or other parameters. As shown, in order for a use to be assessed as fully supporting, all of the core indicators for that use must indicate a fully supporting status, and none of the data associated with the core indicators, or any other parameter used in the assessment, can indicate a threatened or impaired status, as defined by this document. If there is insufficient information for the core indicators to make an attainment decision, and there are no other parameters that indicate a threatened or impaired status, the attainment status will be reported as "insufficient information". This is true even if the attainment status of other parameters (which are not core indicators) indicate a fully supporting attainment status. If however, any of the core indicators and/or other parameters indicates a threatened or impaired status, as defined by the document, the use will be reported as threatened or impaired. Core indicators for each designated use are presented in section 3.2.

Table 3-7: Use Support Options based on Core Indicators and Other Parameters.

Use Support Status based on assessment of Core Indicator(s)	Use Support Status based on Assessment of Other Parameters	Final Use Support Status listed in the ADB
Fully Supporting	Fully Supporting	Fully Supporting
Fully Supporting	Insufficient Information	
Insufficient Information or Not Assessed	Fully Supporting	Insufficient Information or Not Assessed
Insufficient Information	Not Supporting	Not Supporting
Fully Supporting	Not Supporting	
Not Supporting	Not Supporting	
	Fully Supporting	
	Insufficient Information	

3.1.13 Definition of Independent Samples

As discussed in section 3.1.16, assessments are very dependent on the number of "independent samples" taken. It is therefore necessary to define what constitutes an "independent sample" for assessment purposes.

For this assessment, independent samples were defined as:

- Samples taken at least 500 feet (horizontally) from each other regardless of when the samples were taken or,

- Samples taken on different calendar days regardless of the horizontal separation between samples, or

Where there were multiple samples (including samples taken at different depths) that were

a) taken on the same calendar day and

b) located less than 500 feet horizontally from each other,

the worse case value was used as the independent sample for that day and location unless otherwise noted in Section 3.2. For lakes, ponds and large impoundments, only data from the upper layers (i.e., the epilimnion) was used to make assessments in 2002.

3.1.14 Aggregation of Samples within an Assessment Unit

As stated in section 3.1.1, one of the basic premises governing the establishment of assessment units (AUs) was that they should be homogenous. Assuming all AUs were created to be relatively homogenous, it follows that any independent sample taken from an AU is representative of conditions in the AU. Since each independent sample is considered to be representative of the AU, aggregation of independent samples within an AU to assess an AU was allowed.

3.1.15 Spatial Coverage per Sample Site

Spatial coverage is the miles of river or acres of lake, for example, that are assumed to be represented by an independent sample. This statistic is critical for assessments because without it, it would not be possible to estimate the size of waters for the various use support options (e.g., the miles of rivers and streams that are fully supporting).

Assuming a very large coverage per station (e.g., 500 miles per sample site) would result in many miles of river being assessed per sample site. However, the assessment would not be very accurate or defensible unless the upstream watershed was relatively homogenous with regards to the many factors which can influence the impact of a pollutant on a surface water (i.e., waterbody type, physical characteristics, land use, pollutant sources, etc). It is doubtful that all surface waters in such a large watershed would be that homogenous.

As discussed in section 3.1.1, assessment units (AUs) were established with the intent that they would be homogenous. Consequently, it is appropriate to assume that any independent sample site within an AU is representative of water quality conditions within the AU. With regard to spatial coverage per independent sample site, this translates to the ranges shown in Table 3-8, which assumes only one site per AU. In many cases there were multiple independent sample sites within an AU, which would decrease the average coverage per site. Also presented in Table 3-8, for comparison purposes, are coverages recommended or referenced in EPA guidance (USEPA, 1997). As shown, coverages used in this assessment are below those in EPA guidance and therefore are reasonable based on current practice.

Finally, it is important to understand that for this assessment, information pertaining to an AU was reported for just that AU. That is, data from one AU was not used to assess another AU.

Table 3-8: Spatial Coverage per Independent Sample

Waterbody Type	Units	Spatial Coverage assuming 1 independent sample site per AU	Spatial Coverage recommended or referenced in EPA guidance (USEPA, 1997)
Freshwater Rivers and Streams (miles)	Miles	Average: 3.0 Minimum: 0.002 Maximum: 19.1	Wadable Streams: No more than 5 to 10 miles per station. Large rivers: No more than 25 miles per station
Freshwater Impoundments	Acres	Average: 26.8 Minimum: 0.01 Maximum: 3800	None discussed in EPA guidance
Freshwater Lakes and Ponds	Acres	Average: 128 Minimum: 0.31 Maximum: 44,585	Site specific
Estuaries	Square Miles	Average: 0.52 Minimum: 0.01 Maximum: 4.7	Per EPA guidance (USEPA, 1997) the Washington Department of Ecology uses the following coverage: Open waters: Within a 4 mile radius, which translates to 50 square miles per sampling site. Bay stations: Within a 2 mile radius, which translates to 14 square miles per sampling site. Highly sheltered bays: within a ½ mile radius, which translates to 0.8 square miles per sample site.
Ocean	Square Miles	Average: 3.4 Minimum: 0.002 Maximum: 41.6	See estuaries

3.1.16 Minimum Number of Samples – Binomial Method

The number of samples needed to make a use support decision plays a large role in how defensible and believable the assessment is. Calling a waterbody impaired based on only one sample, for example, always seems questionable no matter how reliable the data may be. But what should the minimum number of samples be before an assessment can be made? As discussed below, statistics can be used to answer this question.

One can never have enough data. The more data there is, the more confident one can be that the data represents actual conditions. In statistical terms the entire collection of all measurements is called the population. Since it is impossible to sample the entire population, it is necessary to try to describe the population based on a subset of the measurements. By doing so, some error is always introduced. Consequently, having an idea of the relationship between error and the number of samples taken to represent the population is of interest.

For water quality assessments, there are basically two types of error; Type I and Type II, which are defined in Table 3-9. To obtain an estimate of the probability of committing Type I and / or Type II errors a statistical tool called the binomial method may be used.

Table 3-9: Definition of Type I and Type II Errors for Assessments

Error	Definition
Type I	The waterbody is assessed as impaired when it is really fully supporting
Type II	The waterbody is assessed as fully supporting when it is really impaired

The binomial method can calculate Type I and II error rates for various combinations of sample size and number of exceedances needed to assess a waterbody as impaired. In order to perform these calculations, however, it is necessary to specify the "actual exceedance rate" in the waterbody for each error type. For Type I and Type II errors, an actual exceedance rate of 10 percent and 25 percent, respectively, was assumed. This is consistent with EPA guidance (USEPA, 1997) which recommended assessing a water as fully supporting if the percentage of exceedances for certain pollutants (dissolved oxygen, acute toxicity, bacteria, water temperature and pH) was 10 percent or less. For assessing a water as not supporting, the guidance recommended that the percentage of exceedances equal 25 percent or more. In general, the higher the actual exceedance rate, the lower the error.

When selecting the appropriate combination of sample size and number of exceedances to assess a water as impaired, the goal is to balance and minimize the error rates as much as possible while keeping the number of samples required to make an assessment within reason. For many of the indicators used in this assessment, Table 3-10 was used which is primarily based on maintaining the Type I error at or below 20 percent; that is, no more than a 20 percent error that a waterbody is improperly assessed as impaired, when it is really fully supporting.

Table 3-10: Sample Size and Minimum Number of Exceedances (Binomial Method)

Sample Size	Minimum # of exceedances to call a waterbody impaired	Type I Error (1,3)	Type II Error (2)		Sample Size	Minimum # of exceedances to call a waterbody impaired	Type I Error (1,3)	Type II Error (2)
10	3	0.07	0.53		56	8	0.19	0.02
11	3	0.09	0.46		57	9	0.11	0.03
12	3	0.11	0.39		58	9	0.12	0.03
13	3	0.13	0.33		59	9	0.13	0.02
14	3	0.16	0.28		60	9	0.14	0.02
15	3	0.18	0.24		61	9	0.15	0.02
16	4	0.07	0.40		62	9	0.16	0.02
17	4	0.08	0.35		63	9	0.17	0.01
18	4	0.10	0.31		64	9	0.19	0.01
19	4	0.11	0.26		65	9	0.20	0.01
20	4	0.13	0.23		66	10	0.12	0.02
21	4	0.15	0.19		67	10	0.13	0.02
22	4	0.17	0.16		68	10	0.14	0.01
23	4	0.19	0.14		69	10	0.15	0.01
24	5	0.09	0.25		70	10	0.16	0.01
25	5	0.10	0.21		71	10	0.17	0.01
26	5	0.11	0.18		72	10	0.18	0.01
27	5	0.13	0.16		73	10	0.19	0.01
28	5	0.14	0.14		74	11	0.12	0.01
29	5	0.16	0.12		75	11	0.13	0.01
30	5	0.18	0.10		76	11	0.14	0.01
31	5	0.19	0.08		77	11	0.14	0.01
32	6	0.09	0.15		78	11	0.15	0.01
33	6	0.11	0.13		79	11	0.16	0.01
34	6	0.12	0.11		80	11	0.17	0.00
35	6	0.13	0.10		81	11	0.18	0.00
36	6	0.15	0.08		82	11	0.19	0.00
37	6	0.16	0.07		83	12	0.12	0.01
38	6	0.17	0.06		84	12	0.13	0.01
39	6	0.19	0.05		85	12	0.14	0.00
40	7	0.10	0.10		86	12	0.15	0.00
41	7	0.11	0.08		87	12	0.16	0.00
42	7	0.12	0.07		88	12	0.17	0.00
43	7	0.13	0.06		89	12	0.18	0.00
44	7	0.15	0.05		90	12	0.19	0.00
45	7	0.16	0.04		91	12	0.20	0.00
46	7	0.17	0.04		92	13	0.13	0.00
47	7	0.19	0.03		93	13	0.14	0.00
48	8	0.10	0.06		94	13	0.14	0.00
49	8	0.11	0.05		95	13	0.15	0.00
50	8	0.12	0.05		96	13	0.16	0.00
51	8	0.13	0.04		97	13	0.17	0.00
52	8	0.14	0.03		98	13	0.18	0.00
53	8	0.16	0.03		99	13	0.19	0.00
54	8	0.17	0.02		100	13	0.20	0.00
55	8	0.18	0.02					

Notes:
1. Type I error assumes a 10% actual exceedance rate.
2. Type II error assumes a 25% actual exceedance rate
3. The number of exceedances required to assess a water as impaired is based on maintaining a Type I error of no more than 20%.

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In accordance with Table 3-10, a minimum of 10 samples was used in this assessment to say a parameter was attaining standards. Assuming there were 10 samples, up to 2 of the samples can exceed criteria, and the parameter will still be considered to be meeting standards. As the number of samples increase, the number of exceedances allowed also increases. For example, if 20 samples are taken, Table 3-10 shows the parameter would be considered as meeting standards as long as no more than 3 of the 20 samples exceed criteria.

Table 3-10 also shows the number of exceedances needed to assess a water as impaired as a function of the total sample size. For example, if the total number of samples is less than 15, a parameter would be considered in violation of its criteria if there are 3 or more exceedances. If there are between 16 and 23 samples (inclusive), the number of exceedances required to call a waterbody impaired increases to 4.

At a sample size of 10, Table 3-10 shows that there is a 7 percent chance of improperly listing a water as impaired (Type I error) and a 53 percent chance of improperly assessing a water as fully supporting when it is actually impaired (Type II error). As sample size increases, the Type I and II errors generally become closer in agreement.

In general, the number of exceedances needed to assess a water as impaired increases and the difference between the Type I and II errors decreases, as the sample size increases. As indicated in the following section (Magnitude of Exceedance Criteria), however, there are circumstances where only 2 exceedances are needed to make an impairment decision

3.1.17 Magnitude of Exceedance Criteria (MAGEXC)

The binomial table discussed in the previous section is a good, statistically-based, defensible tool for determining the minimum number of water quality violations needed to assess a water as impaired under most conditions. It does not, however, account for situations where water quality criteria are exceeded by large amounts and it is abundantly clear that there is impairment. In such cases, just a few samples should be needed to make an impairment decision.

To address these situations, "Magnitude of Exceedance Criteria" (MAGEXC) were established for many of the assessment parameters presented in Section 3.2. As shown in section 3.2, MAGEXC are typically set well above the standard water quality criteria; consequently when MAGEXC criteria are exceeded, one can be reasonably confident that there is impairment. As a general rule, if two or more samples exceeded the MAGEXC, waters were assessed as impaired (i.e., not supporting).

3.1.18 7Q10 Low Flow and Mixing Zone Criteria

7Q10 low flow: According to Env-Ws 1705.02 of the State's surface water quality regulations (NHDES, 1999), the flow used to calculate permit limits (i.e., NPDES permits for wastewater discharges) for aquatic life criteria and human health criteria for non-carcinogens, shall be the 7Q10 low flow, which is the average seven day low flow that occurs, on the average, once every ten years. This implies that water quality criteria for human health and non-

carcinogens do not apply at flows below the 7Q10 in waters receiving wastewater discharges. Consequently, assessment of surface waters downstream of wastewater discharges were only based on samples taken when river flows were at or above the 7Q10 low flow, as determined by DES.

Mixing Zones: Env-Ws 1702.27 of the State's surface water quality regulations (NHDES, 1999), defines a mixing zone as the a defined area or volume of the surface water surrounding or adjacent to a wastewater discharge where the surface water, as a result of the discharge, might not meet all applicable water quality standards. Mixing zones are prohibited in Class A waters (Env-Ws 1707.01(a)) but are allowed in Class B waters, where designated by DES, if they meet the conditions stipulated in Env-Ws 1707.02 (Minimum Criteria) and Env-Ws 1707.03 (Technical Standards).

Consistent with the above, water quality data used to make assessments were based on samples taken outside of DES designated mixing zones for wastewater treatment facilities. For wastewater treatment facilities where DES has not yet designated an official mixing zone, water quality data used for assessment purposes was from samples taken at least 500 feet downstream of the WWTF discharge.

3.1.19 Use of Predictive Models

A waterbody with potential violations based on predictive modeling, was assessed as threatened instead of impaired (not supporting), to reflect the fact that the violation is predicted and not based on actual measured in-stream violations, provided that the following conditions apply:

- The model is calibrated and verified and is considered to be representative of current conditions.

- The model predicts water quality violations under existing loading conditions, and/or under enforceable pollutant loadings stipulated in a NPDES permit.

Assuming that modeling predicts a violation, and assuming that this is the only violation in the waterbody, such waters were assessed as threatened and placed in Category 4b, 4c, or 5 depending on the cause of the threat (pollutant or nonpollutant), the source(s) of the threat and whether a TMDL would expedite attainment of water quality standards.

Waters were placed in Category 5 if there were multiple non-natural sources contributing to the predicted violation and it was believed that the TMDL process would expedite the development and implementation of a plan to achieve water quality standards, including the establishment of NPDES permit limits. An example where this would apply is when modeling indicates that advanced treatment at a NPDES WWTF, as well as nonpoint source controls, are necessary to meet dissolved oxygen standards. In such cases the identification and allocation of loads included as part of the TMDL process would facilitate and expedite development and implementation of a plan to meet water quality standards.

Such waters were assessed as threatened, but were not placed on Category 5, when modeling predicted a violation for a pollutant where the primary source is clearly known. An example is when dilution calculations used to determine NPDES permit effluent limits for toxic substances (such as chlorine or ammonia), that are normally below detection limits in surface waters, indicates a potential for in-stream violations based on measurements in the effluent. In such cases there is no need to allocate loads among sources as the primary source and solution is clear: include effluent limits for the toxics of concern in the NPDES permit for the WWTF (which are enforceable) and require the WWTF to implement measures that will bring it in compliance with its NPDES permit. As described in section 3.1.6, the cause of the threatened waters in this case was flagged as a nonpollutant to clearly distinguish it from waters needing a TMDL (Category 5).

3.1.20 NPDES Permit Effluent Violations

Waters receiving effluent from wastewater treatment facilities (WWTF) that have recently violated their NPDES permit effluent limits, were assessed as threatened with the following conditions:

- The wastewater treatment facility (WWTF) is currently in "significant non-compliance" of its NPDES permit (as defined by EPA), or is on the "exceptions list" (i.e. facilities that are in significant non-compliance for two or more quarters), for one or more of its permitted water quality based pollutant effluent limits. Water quality based effluent limits are limits based on modeling or dilution calculations to meet water quality standards.

- Violations of technology based permitted effluent limits (i.e., secondary limits for municipal WWTFs) were not listed as threatened.

Such waterbodies were assessed as threatened but were not be placed in Category 5 because the allowable pollutant loading needed to meet water quality standards has already been established in the NPDES permit (an enforceable document); consequently a TMDL is not needed. This will be accomplished by flagging the cause of the threatened water as a nonpollutant for reasons discussed in section 3.1.6. Since the target for meeting water quality standards is known, the next step is to develop and implement a plan to bring the discharger into compliance with its NPDES permit as soon as possible.

3.1.21 Unknown Sources

Causes of threatened or impaired waters with unknown sources were assessed as threatened or impaired and were placed in Category 5. If future investigations indicate that the source is primarily natural, the water will be moved to Category 4C for reasons discussed in section 3.1.7.

3.1.22 Conflicting Assessment Information

See section 3.1.23, step 4.

3.1.23 Process for Determining Waters that Belong on the 303(d) List (Category 5)

Delisting is the term commonly used to describe the process of removing a waterbody from a 303(d) list (Category 5). According to federal regulation (40 CFR 130.7), states must demonstrate "good cause" for not including waters on the list. Good cause can include, but is not limited to:

- more recent or accurate information,
- more sophisticated water quality modeling,
- flaws in the original analysis that led to the water being listed,
- changes in conditions (e.g., new control equipment, or elimination of discharges.

Consistent with the above, the following process was used to determine which impaired or threatened waters belonged on the 303(d) list (Category 5) and which should be listed in the other categories for impaired or threatened waters (4a, 4b, or 4c). This process was carried out for each individual pollutant that threatens or causes impairment in an AU, as it is possible that one cause of impairment may require a TMDL but another does not.

Step 1: Is the cause of the threatened or impaired water a pollutant?

To be eligible for a TMDL and included in category 5, the waterbody must be threatened or impaired by pollutant(s) versus nonpollutant(s) as defined and discussed in section 3.1.5. Consequently, it is first necessary to know what is threatening or causing impairment in a waterbody.

If the cause is known to be a pollutant, or if it is not known if the cause is a pollutant or nonpollutant, proceed to step 2.

If the cause was due to a nonpollutant , the cause of impairment was flagged as a nonpollutant in the ADB to clearly distinguish it from pollutants requiring a TMDL (see section 3.1.6). Where the cause is unknown, additional investigations will be conducted to determine the cause.

Step 2: Has a TMDL already been completed for the pollutant?

Having determined that the cause is due (or possilbly due) to a pollutant, the next step is to determine if a TMDL has already been conducted for that pollutant in that waterbody.

If a TMDL has not been conducted, proceed to step 3.

If a TMDL has been conducted, the pollutant was flagged as a nonpollutant in the ADB to clearly distinguish it from pollutants requiring a TMDL (see section 3.1.6).

Step 3: Is the source of the pollutant natural?

The next step is to determine the source of the pollutant as this can influence whether a TMDL is needed and, consequently, if the waterbody should be listed on Category 5.

As discussed in section 3.1.7 exceedances of most water quality criteria due to naturally occurring conditions are allowed and are not considered violations of the water quality standards. Since such waters are not technically in violation of the standards, a TMDL is not necessary for waters impaired or threatened by naturally occurring sources.

If the primary source is not natural, proceed to step 4.

If the source of the pollutant was confirmed as natural in accordance with section 3.1.7 the waterbody was assessed as threatened or impaired, but was not placed in category 5. This was done by flagging the cause as a nonpollutant as discussed in section 3.1.6.

Step 4: Are there other pollution control requirements that are reasonably expected to result in attainment of water quality standards in the future?

The last step for determining if a waterbody should be listed on Category 5 is to evaluate whether controls other than a TMDL are likely to result in attainment of water quality standards in the near future. These are handled on a case-by-case basis. In general, AUs do not have to be listed on Category 5 if other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard applicable to such water. Examples include the following:

- Impairment due to discharges of human sewage (i.e., due to illicit connections or combined sewer overflows) where an enforceable order is in place that will result in attainment of water quality standards.
- Waters where restoration efforts are underway or complete and there is an enforceable permit in place that requires attainment of water quality standards. An example includes landfills that have been closed and capped to control iron and manganese violations in adjacent surface waters.

If controls other than a TMDL were expected to result in attainment of water quality standards, the waterbody was assessed as threatened or impaired, however, the cause was flagged as a nonpollutant to distinguish it from other pollutants needing a TMDL in the waterbody (see section 3.1.6).

If after going through steps 1 through 4, a cause of impairment qualified as a TMDL candidate, it was placed on Category 5 and the cause of the threatened or impaired water was flagged as a pollutant in the ADB.

3.1.24 Reasons Why a Waterbody May Change Categories (including Delisting)

Once a waterbody is in a particular category, it may be switched to another category for any of the reasons shown below. This also applies to removing or "de-listing" waters from the 303(d) list (category 5).

- If *new data or information* (including more sophisticated modeling) indicates that the category previously assigned to a waterbody should be changed based on the most current assessment methodology.

- If *flaws are found in the original analysis* which indicates that the waterbody was improperly assessed and should be placed in another category.

- If there are *changes in the assessment methodology* and reassessment of the waterbody indicates it should be placed in another category. This includes changes in water quality standards and/or changes in surrogate water quality criteria used to make use support decisions.

However, as discussed in section 3.1.9, a waterbody may not be removed from a threatened or impaired category based solely on data age. That is, once a waterbody is assessed as threatened or impaired, it cannot be shifted to another category a few years later simply because the data used to make the original assessment no longer meets the data age requirements. This was never the intent as it promotes inaction rather than action to address water quality concerns. Any data used to originally list a waterbody as threatened or impaired, remains eligible for use in any reassessment of the waterbody. Consequently if no new data has been collected and if the original data (regardless of its age) is of adequate quality and includes a sufficient number of violations to assess it as impaired in accordance with this methodology, it would remain in a threatened or impaired category. However, if for any of the other reasons noted above, reassessment indicates that the waterbody was improperly assessed, it can be moved to another category.

The above rules were also used to reassess waters on the 1998 303(d) list as discussed in the following section.

3.1.25 Reassessment of Waters on the 1998 303(d) List

Prior to 2002, the 1998 303(d) list was the last 303(d) list prepared for New Hampshire. A downloadable copy of the 1998 list and the assessment methodology used to develop it may be obtained from www.des.state.nh.us/wmb/wmbpubs.htm.

The methodology used to develop the 1998 list was substantially different from this assessment methodology. In addition, the format of the 1998 list was different as the integrated listing approach had not yet been developed. As shown below the 1998 list consisted of five tiers.

Table 3-11: Description of Tiers used in the 1998 303(d) List

Tier	Description
1	Waters requiring a TMDL
2	Waters which may require pollution control activities other than TMDLs
3	Waters which require additional monitoring
4	Waters which have little or no supporting information
5	Waters which no longer have water quality standard violations

All waters in all five tiers on the 1998 303(d) list were reassessed in accordance with this assessment methodology and placed in the appropriate category.

3.1.26 TMDL Priority Ranking

Section 303(d) of the Clean Water Act requires that waters on the 303(d) List be ranked in order of priority that the TMDLs will be developed. In New Hampshire the TMDL priority ranking process is a two-step process. As shown in Table 3-12, a preliminary rank of high, medium or low is first established based on the water resource that is impacted and whether the pollutants pose a threat to human health or to federally listed threatened or endangered species. Knowing the preliminary water resource ranking, the final TMDL priority ranking is then determined by consulting Table 3-13, which includes other important institutional and technical factors that can influence the priority of TMDLs.

The intent is to first work on TMDLs ranked as high, followed by medium and low priority TMDLs. In general, TMDLs ranked as high are TMDLs that are expected to be completed within the next few years. A list of TMDLs currently being worked on may be found on the DES website at www.des.state.nh.us/wmb.

It should be understood that rankings are dynamic and subject to revision due to changes in any one of the institutional or technical factors shown in Table 3-13. It should also be noted that the time it takes to complete a TMDL is not always reflective of its ranking. Differences can be due to such factors as how controversial the TMDL is, the level of complexity and/or the amount of additional data that must be collected.

Before proceeding, it should be noted that for waters threatened or impaired by regional pollutants which are beyond the ability of the State to control, it is recommended that EPA take the lead in conducting TMDLs. Examples of regional pollutants include acid rain, and mercury, polychlorinated biphenyls (PCBs) and dioxin associated with fish and / or shellfish consumption advisories.

Table 3-12: Preliminary TMDL priority based on water resource factors

Water Resource Impacted	Entity at Risk	
Do the pollutant(s) pose a threat to the 1) viability of a potable water supply, 2) an Outstanding Resource Water as defined in Env-Ws 1700 3) waters designated as "natural" under the Rivers Management and Protection Act (RSA 483), and / or 4) a designated beach?	Do the pollutant(s) 1) threaten human health and/or 2) pose a threat to Federally listed threatened or endangered species?	Preliminary water resource based TMDL priority rank
Yes	Yes	High
No	Yes	High
Yes	No	Medium
No	No	Low

Table 3-13: Final TMDL priority ranking

Preliminary water resource based TMDL priority rank (from table 3-12)	Is there a substantial amount of public interest and support?	Are there adequate resources available to conduct the TMDL?	Are there other administrative or legal factors (i.e., the need to support the NPDES program or a court order) that require the TMDL to be completed in the near future?	Is it very likely that the TMDL, once developed, can or will be implemented (is it technologically possible and economically feasible)?	Final TMDL priority rank
High, Medium or Low	-	Yes	Yes	-	High
High, Medium or Low	-	No	Yes	-	Low
High	-	Yes	No	Yes	High
High	Yes	Yes	No	No	Medium
High	Yes	No	No	No	Low
High	No	-	No	No	Low
Medium	Yes	Yes	No	Yes	High
Medium	Yes	Yes	No	No	Medium
Medium	No	Yes	No	Yes	Medium
Medium	Yes	No	No	No	Low
Medium	No	-	No	No	Low
Low	Yes	Yes	No	Yes	High
Low	No	Yes	No	Yes	Medium
Low	No	Yes	No	No	Low
Low	Yes	No	No	No	Low
Low	No	-	No	No	Low

Note: "-" means Yes or No.

3.2 ASSESSMENT CRITERIA BY DESIGNATED USE

3.2.1 Overview

The following tables provide specific assessment criteria for each of the seven designated uses. Each table includes a definition of the use, the applicable surface waters and core indicators for the use, and detailed assessment criteria for various parameters of water quality pertinent to the use, including criteria for the core indicators. This assessment criteria is supplemental to the general assessment criteria provided in section 3.1.

3.2.2 Use: Primary Contact Recreation

Definition: Waters that are suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water**.**

Applicability: All surface waters

Core Indicator(s): Bacteria (Pathogens)

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in section 3.1.**

Indicator 1: **Beach closures or restrictions (for designated beaches only)**

FS: There were no known beach closures or restrictions in effect during the reporting period.

NS: There was one or more bathing area closures or restrictions during the reporting period.

Notes:

1. Bathing area closures or restrictions shall be based on annual bacteria sampling performed by the DES Beach Program at fresh water and tidal waters beaches. At least 3 samples are collected at each designated beach during the summer months. If beach program criteria are exceeded, DES advises the beach owner to post the beach. Such advisories are considered "restrictions" for assessment purposes.

2. Beach closures or restrictions due to heavy swim loads shall not be placed in category 5 (see section 3.1.6).

Indicator 2: **Bacteria (pathogens)**

FS: See criteria presented in table 3-14.

NS: See criteria presented in table 3-14.

Primary Contact Recreation (continued)

Table 3-14: Use Support Matrix for Bacteria (Primary Contact Recreation)

May 24 – September 15 (Critical Period)				September 16 - May 23				Use Support
Geometric Mean (GM)		Single Samples (SS)		Geometric Mean (GM)		Single Samples (SS)		
# of GM Calculations	Results	# SS	Results	# of GM Calculations	Results	# SS	Results	
≥ 1	< GMC	≥ 0	< SSMC	≥ 0	< GMC	≥ 0	< SSMC	FS
≥ 0	< GMC	≥ 2	< 75% of GMC					
0		≤ 1	< SSMC	≥ 0	< GMC	≥ 0	< SSMC	INSUFFICIENT INFORMATION or NOT ASSESSED
0		≥ 2 and ≥ 1	< SSMC ≥ 75% GMC but < SSMC					
0 exceedances of the GMC and only 1 exceedance of the SSMC								
≥ 1 exceedance of the GMC and/or ≥ 2 exceedances of the SSMC								NS

Notes:

1. Water Quality Criteria (WQC)

	Bacteria	Geometric Mean Criteria (GMC)	75% of GMC	Single Sample Maximum Criteria (SSMC)
Class A Fresh water	Escherichia coli	47	35	153
Class B Fresh water	Escherichia coli	126	95	406
Class B Tidal water	Enterococci	35	26	104

2. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-14 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

3. As indicated in Table 3-14, to be FS, there must be sufficient data to make an assessment during the peak contact recreation season (May 24 to September 15).

Primary Contact Recreation (continued)

4. Single Samples are independent samples that were not used to calculate a GM.

5. Calculation of the geometric mean (GM) shall only be based on independent samples collected at the same station. To calculate the GM, there must be at least 3 independent samples (i.e., samples taken on different days) collected within 60 consecutive days.

6. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 3: Discharges of Untreated Sewage

FS: There are no known discharges of untreated sewage.

NS: There are known or highly suspected discharges of untreated sewage.

Notes:

1. The primary pollutant of concern in untreated sewage is bacteria (pathogens).

2. Examples of sources of untreated sewage discharges include connections of sanitary sewer pipes to storm drains (i.e., illicit connections), combined sewer overflows (CSOs), and sanitary sewer overflows (SSOs) that discharge to surface waters.

3. Evidence of suspected discharges of untreated sewage include physical evidence (feces, toilet paper, etc.), odors of sewage, chemical evidence (i.e., chlorine or elevated levels of ammonia in a pipe) and / or elevated bacteria concentrations in the pipe.

4. Waters listed as NS due to bacteria (pathogens) from untreated sewage discharges will not be placed on Category 5 for reasons discussed in section 3.1.23.

Indicator 4: Chlorophyll a (chlor a)

FS: See criteria presented in table 3-15.

NS: See criteria presented in table 3-15.

Primary Contact Recreation (continued)

Table 3-15: Use Support Matrix for Chlor a

May 24 – September 15 (Critical Period) Sample Size	September 16 - May 23 Sample Size	Total Sample Size	Total # WQC Exceedances	Total # of MAGEXC Exceedances	Use Support
≥ 10	≥ 0	≥ 10	< # exceedances shown on the table 3-10 for the total sample size	0	FS
		< 10	< 3	≤ 1	INSUFFICIENT INFORMATION or NOT ASSESSED
< 10	≥ 1	≥ 10	< # exceedances shown on table 3-10 for the total sample size	≤ 1	
		≤ 10	≥ 3	≥ 0	NS
		> 10	≥ # exceedances shown on table 3-10 for the total sample size	≥ 0	
		≥ 2	≥ 2	≥ 2	

Notes:

1. Assessments using chlor a concentrations shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-15 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. Exceedances of the water quality criteria (WQC) are defined as:

   Chlor a ≥ 25 ppb

3. Exceedances of the Magnitude of Exceedance Criteria (MAGEXC) for chlor a are defined as:

   Chlor a ≥ 50 ppb

Primary Contact Recreation (continued)

4. Waters assessed as NS for this indicator may or may not be listed as threatened or impaired in Category 5 depending on other circumstances in the waterbody (see section 3.1.23).

5. As indicated in Table 3-15, to be FS, there must be sufficient data to make an assessment during the peak contact recreation season (May 24 to September 15).

6. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 5: Color, foam, debris, scum, slicks, odors, surface floating solids

FS: The surface water does not contain color, foam, debris, scum, slicks, odors, and/or surface floating solids in amounts and for durations that significantly interfere with the primary contact recreational use, unless naturally occurring.

NS: The surface water contains color, foam, debris, scum, slicks, odors and/or surface floating solids in significant amounts and for durations that significantly interfere with the primary contact recreational use, and they are not naturally occurring.

Notes:

1. It is not the intent of this indicator to assess a surface water as impaired for an occasional case of litter or debris. Rather this indicator is intended to address more significant, chronic cases of pollution.
2. This indicator can be used for iron hydroxide deposits due to iron in groundwater from landfills that produce objectionable scums of iron hydroxide floc and taint the water orange.
3. See section 3.1.23 for determining waters that should be placed in Category 5.

3.2.3 Use: Secondary Contact Recreation

Definition: Waters that support recreational uses that involve incidental contact with the water

Applicability: All surface waters

Core Indicator(s): Bacteria (Pathogens)

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in Section 3.1.**

Indicator 1: **Bacteria (pathogens)**

FS: See criteria presented in table 3-16.

NS: See criteria presented in table 3-16.

Table 3-16: Use Support Matrix for Bacteria (Secondary Contact Recreation)

<table>
<tr><td colspan="4">May 24 – September 15
(Critical Period)</td><td colspan="4">September 16 - May 23</td><td rowspan="3">Use Support</td></tr>
<tr><td colspan="2">Geometric Mean (GM)</td><td colspan="2">Single Samples (SS)</td><td colspan="2">Geometric Mean (GM)</td><td colspan="2">Single Samples (SS)</td></tr>
<tr><td># of GM Calculations</td><td>Results</td><td># SS</td><td>Results</td><td># of GM Calculations</td><td>Results</td><td># SS</td><td>Results</td></tr>
<tr><td>≥ 1</td><td>< GMC</td><td>≥ 0</td><td>< SSMC</td><td rowspan="2">≥ 0</td><td rowspan="2">< GMC</td><td rowspan="2">≥ 0</td><td rowspan="2">< SSMC</td><td rowspan="2">FS</td></tr>
<tr><td>≥ 0</td><td>< GMC</td><td>≥ 2</td><td>< 75% of GMC</td></tr>
<tr><td>0</td><td></td><td>≤ 1</td><td>< SSMC</td><td rowspan="3">≥ 0</td><td rowspan="3">< GMC</td><td rowspan="3">≥ 0</td><td rowspan="3">< SSMC</td><td rowspan="3">INSUFFICIENT INFORMATION or NOT ASSESSED</td></tr>
<tr><td>0</td><td></td><td>≥ 2
and
≥ 1</td><td>< SSMC

≥ 75% GMC but < SSMC</td></tr>
<tr><td colspan="8">0 exceedances of the GMC and only 1 exceedance of the SSMC</td></tr>
<tr><td colspan="8">≥ 1 exceedance of the GMC
and/or
≥ 2 exceedances of the SSMC</td><td>NS</td></tr>
</table>

Secondary Contact Recreation (continued)

Notes:

1. Water Quality Criteria

	Bacteria	Geometric Mean Criteria (GMC)	75% of GMC	Single Sample Maximum Criteria (SSMC)
Class A Fresh water	Escherichia coli	235	176	765
Class B Fresh water	Escherichia coli	630	473	2030
Class B Tidal water	Enterococci	175	131	520

2. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-16 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

3. As indicated in Table 3-16, to be FS, there must be sufficient data to make an assessment during the peak contact recreation season (May 24 to September 15).

4. Single Samples are independent samples that were not used to calculate a GM.

5. Calculation of the geometric mean (GM) shall only be based on independent samples collected at the same station. To calculate the GM, there must be at least 3 independent samples (i.e., samples taken on different days) collected within 60 consecutive days

6. See section 3.1.23 for determining waters that should be placed in Category 5.

3.2.4 Use: Aquatic Life

Definition: Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.

Applicability: All surface waters

Core Indicator(s):

Dissolved Oxygen	(for all surface waters)
pH	(for all surface waters)
Biological (biomonitoring)	(for tidal waters and freshwater rivers and streams)

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in Section 3.1.**

Indicator 1: **Dissolved Oxygen (DO)**

FS: See criteria presented in table 3-17.

NS: See criteria presented in table 3-17.

Table 3-17: Use Support Matrix for Dissolved Oxygen

Total Sample Size	Total # WQC Exceedances	Total # of MAGEXC Exceedances	Use Support
≥ 10	< # shown table 3-10 for the total sample size	0	FS
< 10	< 3	1	INSUFFICIENT INFORMATION or NOT ASSESSED
≥ 10	< # shown table 3-10 for the total sample size	1	
< 10	≥ 3	≥ 0	NS
≥ 10	$\geq$ # shown table 3-10 for the total sample size	≥ 0	
≥ 2	≥ 2	≥ 2	

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-17 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. To be assessed as FS for dissolved oxygen:

   a. There must be sufficient data to indicate that all appropriate DO criteria are met (i.e., instantaneous minimum, daily average and in some cases, the 7 day mean as well).

   b. Samples must be taken during critical times and seasons depending on the water type and use:

Aquatic Life (continued)

If the surface water is not a cold water natural reproducing fishery), at least 50% of the minimum number of independent samples needed for FS, shall be taken between June 1 and September 30. This is when DO is most apt to be lowest due to high temperatures and low flows.

In surface waters that are cold water natural reproducing fisheries, 100 % of the minimum number of independent samples needed for FS determination shall be taken between October 1 and May 14

3. Exceedances of the Water Quality Criteria (WQC) for DO are defined as:

Applicable waters	Daily Average Measurement	Instantaneous Measurement
Class A: Applies to any depth	< 75% saturation	< 6 mg/L
Class B: Applies to any depth in free flowing rivers and tidal waters and in the epilimnion (if stratified) or in the top 25% of depth (if not stratified) in lakes, ponds, impoundments and reservoirs. Note that DO in lower depths of lakes, ponds impoundments and reservoirs must support existing and designated uses. .	< 75% saturation	< 5 mg/L
Class A or B cold water fish spawning areas whose early life stages are not directly exposed to the water (i.e., cold water naturally reproducing fisheries). Applies to any depth in free flowing rivers and tidal waters and in the epilimnion (if stratified) or in the top 25% of depth (if not stratified) in lakes, ponds, impoundments and reservoirs.	From 10/1 to 5/14, a 7 day mean DO based on the daily average of < 9.5 mg/L	From 10/1 to 5/14 DO < 8 mg/L

4. Exceedances of the Magnitude of Exceedance Criteria (MAGEXC) for DO are defined as:

$$DO \leq 4.0 \text{ mg/L}$$

5. Daily Average Considerations: Comparison to the daily average criteria above shall be based on the time weighted average of DO measurements taken at the same location and a maximum of one hour apart for 24 continuous hours with the following exception:

If there is insufficient data to calculate a time weighted daily average, the following method (the average method) can be employed to determine use support based on the daily average. If there is data for samples taken between 5 am and 8:00 am and between 11 am and 2 pm on the same day, the average of the highest and lowest samples

Aquatic Life (continued)

may be used as an estimate of the daily average and compared to the following criteria for determining use support.

FS if $\geq$ 85%

NS if $\leq$ 65%

If the result is > 65%, but < 85% saturation, there is insufficient information to determine use support based on the average method.

.

6. Each daily average calculation is an independent sample for comparison to daily average criteria. Each 7 day mean calculation is considered an independent sample for comparison to 7 day mean criteria. For comparison to the instantaneous minimum or MAGEX criteria, independent samples shall be those taken on different calendar days. If more than one sample is taken on a given calendar day, the worse case sample will be the independent sample for that day. If there are multiple vertical profile measurements at a station, the lowest measurement shall be the independent sample for that day.

7. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 2: pH

FS: See criteria presented in table 3-18.

NS: See criteria presented in table 3-18.

Table 3-18: Use Support Matrix for pH

Total Sample Size	Total # WQC Exceedances	Total # of MAGEXC Exceedances	Use Support
$\geq$ 10	< # shown table 3-10 for the total sample size	0	FS
< 10	< 3	1	INSUFFICIENT INFORMATION or NOT ASSESSED
$\geq$ 10	< # shown table 3-10 for the total sample size	1	INSUFFICIENT INFORMATION or NOT ASSESSED
< 10	$\geq$ 3	$\geq$ 0	NS
$\geq$ 10	$\geq$ # shown table 3-10 for the total sample size	$\geq$ 0	NS
$\geq$ 2	2	2	NS

Notes:

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-18 and must include at least 2 samples

Aquatic Life (continued)

collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. Exceedances of the Water Quality Criteria (WQC) for pH are defined as:

$$pH < 6.5 \quad or \quad pH > 8.0$$

3. Exceedances of the Magnitude of Exceedance Criteria (MAGEXC) for pH are defined as:

$$pH < 5.5 \quad or \quad pH > 9.0$$

4. Absent other sources that could significantly impact pH, low pH exceedances in waters where the apparent color was greater than 30 cpu were considered due to natural sources (i.e., natural tannic and humic acids in the water). In tidal waters, pH exceedances greater than 8.0, but less than or equal to 8.8, were considered natural. Such waters were listed under Category 4C unless there were other impairment(s) in the Assessment Unit that indicate that Category 4B or 5 is appropriate.

5. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 3: Biological Assessments (Water Column)

FS: See criteria presented in table 3-19.

NS: See criteria presented in table 3-19.

Table 3-19: Use Support Matrix for Mean Water Quality Score

Mean Water Quality Score	Use Support
≥ 7.5	FS
> 2.5 but < 7.5	INSUFFICIENT INFORMATION
≤ 2.5	NS

Notes:

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-19 and must include biomonitoring data collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

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2. Assessments shall be based on data collected in accordance with DES biomonitoring protocols, which include the deployment and collection of rock baskets during the summer months. A description of the DES biomonitoring program may be found in the 2000 305(b) Report (NHDES, 2000).

3. The water quality score presented in Table 3-19 was determined by the following method which is based on model designed by the New York Department of Environmental Conservation:

Scores for 3 biometrics [percent model affinity (PMA), taxa richness (Total Taxa) and Ephemeroptera, Plecoptera and Trichoptera abundance (EPT)] and habitat were determined for each site. Each score was then plotted on a modified "O Brien Plot" of Index Values (see Table 3-20). The corresponding water quality score for each biometric and habitat value was then recorded. The mean water quality score was then computed and used to determine use support for the site (see Table 3-20).

Table 3-20: Modified "O'Brien Plot" of Index Values

Water Quality Score	Total Taxa	EPT	PMA	Habitat
10	20	15	90	200
7.5	15	10	65	150
5.0	10	5	50	100
2.5	5.0	2.0	35	50
0	0	0	0	0

4. NH is in the process of developing numeric biomonitoring water quality standards for wadable streams. Consequently, the methodology described above for determining use support is considered an interim method and is likely to change in the future when numeric water quality standards are adopted.

5. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 4: Habitat Assessments

FS: See criteria presented in table 3-21.

NS: See criteria presented in table 3-21.

Aquatic Life (continued)

Table 3-21: Use Support Matrix for Habitat Assessment Score

Habitat Assessment Score	Use Support
> 10 for all parameters (optimal and suboptimal) and bioassessment results support this designation or ≤ 10 for one or more parameters due to naturally occurring conditions. .	FS
≤ 10 for one or more parameters (marginal or poor) and bioassessment results support this designation and it is not due to naturally occurring conditions.	NS

Notes:

1. Habitat information for habitat scoring is collected when bioassessments are conducted. It is based on visual observations using standard protocols and assessment sheets that address ten specific habitat parameters for low and high gradient streams. Habitat parameters include epiphaunal substrate/available cover, pool substrate characterization, pool variability, sediment deposition, channel flow status, channel alteration, channel sinuousity, bank stability, vegetative protection, and riparian vegetative zone width. Each parameter was then given a score from one to twenty. These values were then compared to Table 3-21 to determine use support.

2. A FS habitat score is indicative of naturally occurring stream morphology, substrate composition, natural riparian physical and vegetative structure and stability, flow regime and minimal to no anthropogenic influences within a spatial range that could induce stressed or impaired habitat conditions.

3. A NS habitat score is indicative of obvious non-naturally occurring influences that are considered marginal to severe.

4. As discussed in section 3.1.6, habitat is considered a nonpollutant; consequently waters impaired solely because of habitat will not be placed in Category 5.

Indicator 5: Water Quality Criteria for Toxic Substances in the Ambient Water

FS: See criteria presented in table 3-22.

NS: See criteria presented in table 3-22.

Aquatic Life (continued)

Table 3-22: Use Support Matrix for Toxic Substances

Total Sample Size	Total # WQC Exceedances in any 3 year period	Total # of MAGEXC Exceedances in any 3 year period	Use Support
$\geq$ 10	< # shown table 3-10 for the total sample size	0	FS
< 10	< 3	1	INSUFFICIENT INFORMATION or NOT ASSESSED
$\geq$ 10	< # shown table 3-10 for the total sample size	1	INSUFFICIENT INFORMATION or NOT ASSESSED
< 10	$\geq$ 3	$\geq$ 0	NS
$\geq$ 10	$\geq$ # shown table 3-10 for the total sample size	$\geq$ 0	NS
$\geq$ 2	2	2	NS (for acute criteria only)

Notes:

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-22 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. Acute and chronic Water Quality Criteria (WQC) for chemical specific toxic substances in the water column may be found in the State's surface water quality regulations (NHDES, 1999), Table 1703.1 of Env-Ws1703.21.

3. Exceedances of the Magnitude of Exceedance Criteria (MAGEXC) for chemical specific toxic substances in the water column are defined as

   $\geq$ 2 times the acute WQC

4. NS assessments using metal concentrations below 0.5 mg/L shall only be based on samples collected and analyzed using clean sampling techniques. Above metal concentrations of 0.5 mg/L, the use of clean techniques is not believed to have a significant effect on measured concentrations provided that protocols, such as those followed by the DES Watershed Management Bureau, are followed for sampling and analysis. Clean techniques are also not required for FS assessments. This is based on the premise that clean techniques will always result in measured values that are equal to or less than those taken from samples where clean techniques were not implemented.

5. Waters assessed as impaired based solely on exceedances of the acute and/or chronic chemical specific criteria shall not be considered for placement in category 5 until biological assessments have been conducted to confirm that the aquatic life is

Aquatic Life (continued)

impaired. If biological assessments also indicate impairment, the surface water will be eligible for category 5 depending on other circumstances in the waterbody (see section 3.1.23).

Indicator 6: Toxicity Tests of the Ambient Water

FS: See criteria presented in table 3-23.

NS: See criteria presented in table 3-23.

Table 3-23: Use Support Matrix for Toxicity Tests

Total Sample Size	Total # Acute and/or chronic toxicity tests indicating toxicity in any 3 year period	Use Support
≥ 10	< # shown on the binomial table for the total sample size	FS
< 10	< 3	INSUFFICIENT INFORMATION or NOT ASSESSED
≥ 10	< # shown table 3-10 for the total sample size	INSUFFICIENT INFORMATION or NOT ASSESSED
< 10	≥ 3	NS
≥ 10	≥ # shown table 3-10 for the total sample size	NS
≥ 2	2	NS (for acute criteria only)

Notes:

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-23 and must include at least 2 samples collected in the same general area and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. Acute and chronic toxicity tests shall be in accordance with the EPA protocols.

3. Waters assessed as impaired based solely on exceedances of the acute and/or chronic toxicity tests shall not be considered for placement in category 5 until biological assessments have been conducted to confirm that the aquatic life is impaired and the pollutant(s) causing impairment are known. If biological assessments also indicate impairment and, if the pollutant is known the waterbody will be considered for placement in category 5 as discussed in section 3.1.23.

4. See section 3.1.23 for determining waters that should be placed in Category 5.

Aquatic Life (continued)

Indicator 7: Sediment Quality

FS: See criteria presented in table 3-24.

NS: See criteria presented in table 3-24.

Table 3-24: Use Support Matrix for Sediment Quality

Do sediment chemical analyses exceed Toxic Effect Levels (TEL)?	Do laboratory sediment toxicity surveys indicate toxicity?	Do benthic biological survey results indicate impairment as compared to a reference site(s)?	Use Support
No	No or not measured	No or not measured	FS
Yes	No		
No	Yes	No	FS (but continue monitoring as benthic community may be at future risk)
Yes	Yes	No	
No	Yes	Not measured	Insufficient Information
Yes			
Yes	Not measured		
Not measured		Yes	
Yes	No	Yes	NS
No	Yes		
Yes			

Notes:

1. The use support criteria shown in Table 3-24 is based on the sediment quality triad approach described in the NHDES policy entitled "Evaluation of Sediment Quality" (NHDES, 2002).

2. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 8: Exotic Macrophytes

FS: There are no known communities of exotic macrophytes present in the surface water.

NS: Exotic macrophytes are present in the surface water.

Notes:

1. Exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Examples of exotic macrophytes include variable milfoil (Myriophyllum heterophyllum), Eurasian milfoil (Myriophyllum spicatum), fanwort (Cabomba caroliniana) and

Aquatic Life (continued)

water chestnut (Trapa natans). Such infestations are in violation of Env-Ws 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

2. As discussed in section 3.1.6, exotic macrophytes are considered nonpollutants. Consequently waters impaired by exotic macrophytes will not be placed in Category 5.

Indicator 9: Flow

FS: There is no documented evidence that non-naturally occurring flows were less than the Aquatic Base Flow (ABF), or less than minimum flow requirements established by DES through the Section 401 Water Quality Certification Program over the past 2 years.

NS: There is documented evidence that there have been 2 or more instances over the last 2 years where, of non-naturally occurring flows that were less than the ABF or less than minimum flow requirements established by DES through the Section 401 Water Quality Certification Program.

Notes:

1. Determination of the Aquatic Base Flow shall be in accordance with the United States Fish and Wildlife Service "Interim Policy for New England Streams Flow Recommendations" (USFWS, 1981).

2. Section 401 Water Quality Certifications must be obtained from DES for any project requiring a federal permit or license. This includes most wetland dredge or fill projects as well as Federal Energy Regulatory Commission (FERC) projects (i.e., hydropower projects). As part of this process, DES has the obligation to establish conditions to ensure that the construction and operation of the project will not result in violations of water quality standards. This includes establishment of flow conditions where necessary to ensure that aquatic life is not adversely impacted.

3. As discussed in section 3.1.6, flow is considered a nonpollutant. Consequently waters impaired by flow, will not be placed in category 5.

Indicator 10: Benthic Deposits

FS: Benthic deposits are not present in amounts sufficient to have a significant detrimental effect on the benthic community, other than those that are naturally occurring.

NS: Significant benthic deposits exist which are causing an obvious detrimental impact to the benthic community and, are not naturally occurring.

Notes:

1. This indicator is not intended to address minor cases such as relatively small sediment deposits that occasionally occur at the end of storm drain pipes or cases where biomonitoring or habitat assessments (see indicator 4) have been completed. Rather, this indicator is intended to address the more severe cases where it is obvious

Aquatic Life (continued)

that a significant portion of the benthic community has been adversely impacted due to benthic deposition (usually from smothering). Examples of NS for this indicator include major sediment deposits resulting from severe erosion and major iron hydroxide deposits due to increased iron levels in groundwater from landfills.

2. See section 3.1.23 for determining waters that should be placed in Category 5.

3.2.5 Use: Drinking Water After Adequate Treatment

Definition: Waters that with conventional treatment will be suitable for human intake and meet state/federal drinking water regulations.

Applicability: All fresh surface waters

Core Indicator(s): For existing drinking water supplies:

Compliance with Safe Drinking Water Act (SDWA) standards in the Finished Drinking Water
Finished Drinking Water Restrictions
Contaminants in source water that require more than conventional treatment

For all other fresh surface waters:

Core indicators are under development. For this assessment cycle, all fresh surface waters that are not currently used as drinking water supplies were assigned a use support of " Insufficient Information" or "Not Assessed" for this use.

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in Section 3.1.**

Indicator 1: **Compliance with Safe Drinking Water Act (SDWA) standards in the Finished Drinking Water**

FS: There have been no exceedances of SDWA standards in the finished drinking water (other than occasional bacteria exceedances associated with operator error or equipment failure).

NS: There have been one or more exceedances of the SDWA standards in the finished drinking water (other than occasional bacteria exceedances associated with operator error or equipment failure).

Notes:

1. Existing drinking water supply assessments are based on information provided by the DES Water Supply Engineering Bureau.

Indicator 2: **Finished Drinking Water Restrictions (existing drinking water supplies only)**

FS: There have been no source water closures or advisories that have lasted more than 30 days per year over the past 2 years.

NS: Over the past 2 years, there have been one or more drinking water source advisories lasting more than 30 days per year or one or more closures per year.

Notes:

1. Existing drinking water supply assessments are based on information provided by the DES Water Supply Engineering Bureau.

Drinking Water After Adequate Treatment (continued)

2. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 3: Contaminants in source water that require more than conventional treatment (existing drinking water supplies only)

FS: No source waters have required more than conventional treatment over the past 2 years to enable drinking water uses.

NS: Over the past 2 years, or one or more source waters have required more than conventional treatment to enable drinking water uses due to contaminants in the source water that may adversely affect treatment costs or the quality of finished water (i.e., due to taste, odor, turbidity, dissolved solids, etc.)

Notes:

1. Conventional treatment is defined as coagulation, sedimentation, disinfection, and conventional filtration.

2. Upon request, DES has historically used copper sulfate to control algal blooms caused by cultural sources of phosphorus. In recent years, most copper sulfate treatments have been requested by owners of water supplies to control taste and odor or filter clogging problems associated with algal blooms. Where copper sulfate treatments were conducted for this purpose within the last 2 years, the water supply was assessed as NS as this is considered "more than conventional treatment".

3. See section 3.1.23 for determining waters that should be placed in Category 5.

3.2.6 Use: Fish Consumption

Definition: Waters that support fish free from contamination at levels that pose a human health risk to consumers.

Applicability: All surface waters

Core Indicator(s): Fresh waters: Fish Consumption Advisories based on health risk analyses to determine if advisories are necessary due to mercury in fish tissue.

Tidal waters: Fish Consumption Advisories based on health risk analyses to determine if fish consumption advisories are necessary due to mercury and polychlorinated biphenyls (PCBs) in fish tissue.

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in Section 3.1.**

Indicator 1: **Fish Consumption Advisories due to toxics**

FS: No fish "restricted consumption" or "no consumption" advisories or bans are in effect.

NS: "Restricted consumption" or "no consumption" advisories or bans for fish are in effect.

Notes:

1. Fish consumption advisories are issued by the New Hampshire Department of Health and Human Services. The advisories are based on risk assessments to determine if any portion of the human population would be at risk eating fish due to pollutant concentrations in fish tissue. A summary of fish consumption advisories in NH is available on the web at www.dhhs.state.nh.us/dhhs/hlthriskassess/library

2. All waters with fish consumption advisories or bans due to pollutants that do not need a TMDL for reasons discussed in section 3.1.23 shall not be placed in category 5 for that particular pollutant. For this assessment, this applies to the fish consumption advisory on the Adroscoggin River due to dioxin. The primary source of dioxin was from a paper mill in Berlin. In 1994, the mill changed its bleaching process to a much cleaner, elemental chlorine free process. As a result, dioxin measurements have dropped below minimum detection levels and fish tissue concentrations have declined. Since the source has been essentially eliminated, a TMDL is not needed for this situation.

3. For this cycle, all surface waters in New Hampshire will be placed in Category 5 primarily as a result of the statewide fish consumption advisory for mercury in fresh waters and for mercury and polychlorinated biphenyls (PCB) in tidal waters. For regionally generated pollutants such as mercury, PCBs and dioxins (in some cases) which are beyond the ability of the State to control, it is recommended that EPA take the lead in conducting the TMDLs.

3.2.7 Use: Shellfish Consumption

Definition: Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers

Applicability: All tidal waters

Core Indicator(s): Classification of shellfish waters based on fecal coliform concentrations (pathogens) in the water column in accordance with the National Shellfish Sanitation Program (NSSP).

Shellfish Consumption Advisories based on health risk analyses to determine if shellfish consumption advisories are necessary due to mercury and polychlorinated biphenyls (PCBs) in fish tissue.

Assessment Criteria: **The following criteria are in addition to the general assessment and listing criteria provided in Section 3.1.**

Indicator 1: **NSSP classifications based on fecal coliform concentrations (pathogens) in the water column.**

FS: The surface water is classified as "approved" based on fecal coliform violations measured and assessed in accordance with the NSSP criteria**.**

NS: The surface water is not classified as "approved" based on fecal coliform violations measured and assessed in accordance with the NSSP criteria.

Notes:

1. The DES Shellfish Program is responsible for implementing the NSSP program and for determining NSSP classifications.

2. Shellfish areas classified as conditionally approved, restricted, conditionally restricted, prohibited, or closed will be assessed as NS. Areas closed for administrative reasons such as lack of a current sanitary survey or a safety management zone around wastewater treatment plants or marinas, or where there is insufficient fecal coliform data to assess the water per the NSSP protocols, will be placed in Category 3.

3. See section 3.1.23 for determining waters that should be placed in Category 5.

Indicator 2: **Shellfish Consumption Advisories due to toxics**

FS: There are no "restricted consumption" or "no consumption" advisories or bans for shellfish in effect.

NS: "Restricted consumption" or "no consumption" advisories or bans for shellfish are in effect.

Notes:

1. Shellfish consumption advisories are issued by the New Hampshire Department of Health and Human Services. The advisories are based on risk assessments to determine if any portion of the human population would be at risk eating shellfish

due to toxics in shellfish tissue. A summary of fish consumption advisories in NH is available on the web at www.dhhs.state.nh.us/dhhs/hlthriskassess/library.

Shellfish Consumption (continued)

2. All waters with shellfish consumption advisories or bans shall be listed as impaired and either placed in Category 4B or 5 depending on the status of efforts to reduce shellfish tissue pollutant concentrations to levels that do not warrant an advisory.

3. For this cycle, all tidal waters in New Hampshire were placed in Category 5 primarily as a result of the shellfish consumption advisory for mercury and polychlorinated biphenyls (PCB). For regionally generated pollutants such as mercury, PCBs and dioxins (in some cases) which are beyond the ability of the State to control, it is recommended that EPA take the lead in conducting the TMDLs.

3.2.8 Use: Wildlife

Definition: Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.

Applicability: All surface waters

Core Indicator(s): Under development

Assessment Criteria: Criteria for determining use support is under development. For this cycle, all surface waters will be assessed as "Not Assessed" for this use.

CHAPTER 4 COMPREHENSIVE MONITORING STRATEGY

4.1 EXISTING MONITORING PROGRAMS

Proper and efficient management of water resources is very dependent on the quantity and quality of data collected. Consequently it is important for each state to develop and implement a comprehensive monitoring program that will provide the data needed to make correct water quality management decisions.

A general overview of surface water monitoring programs in New Hampshire may be found in the 2000 305(b) Report (NHDES, 2000), which is available on the web at www.des.state.nh.us/wmb/wmbpubs.htm. For the most part, sampling of most waterbodies in the State is conducted during the summer months, with a few exceptions for tidal waters and some lakes. Historically, the vast majority of sampling has typically been based on targeted (versus random or probabilistic based) monitoring designs.

4.2 STATUS OF COMPREHENSIVE MONITORING STRATEGY

The 2000 305(b) Report referenced above includes a draft Comprehensive Monitoring Strategy (CMS) for rivers and lakes. Since the 2000 305(b) report was completed, EPA has prepared additional guidance to clarify what is meant by an adequate state program and what should be included in a CMS (USEPA, 2001). EPA has also issued recent guidance on different monitoring approaches that states may wish to consider (USEPA, 2002). By 2004, DES intends to update its draft CMS to be more consistent with the latest guidance. A major first step was the development of this Consolidated Assessment and Listing Methodology, which will play an integral role in the preparation of the CMS.

CHAPTER 5 REFERENCES

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